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PROGRESS AGAINST THE 2021-2030 SHARK RESEARCH PLAN - 2026

WCPFC-SC22-2026-SA-IP24
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Introduction

The Shark Research Plan (Brouwer and Hamer 2020) (report of Project 97) was adopted by SC16 and endorsed by WCPFC17 in December 2020. The current Shark Research Plan (SRP) is the 3rd phase of the WCPFC's SRP that builds on the previous two plans. This plan had a mid-term review in 2023 (Brouwer and Hamer 2023) and as part of that review the SC19 recommended that the 2021-2025 SRP be extended to 2030. The 2021 - 2030 SRP is a living document that can evolve based on the information needs and priorities of the WCPFC. The plan has annual reviews to evaluate the progress and ensure that the next years' work remains relevant and required.

SC19 and WCPFC20 agreed that shark assessments would be carried out over two years. The first year provides time (4-5 months) to collate the data, undertake fishery characterisations, develop catch reconstructions and provide SC with a recommendation on the possibility and approaches that might be suitable for a stock assessment. The second year of the assessment focuses on the stock assessment modelling, which may also include risk assessment methods if requested by SC.

Purpose and tasks of the SRP

The purpose of this document is to review progress against the SRP and facilitate future planning of WCPFC shark research. The SC is tasked to review the proposed work in the SRP and update the research plan as needed. These updates on the 2021 - 2030 SRP as well as the work progressed against that project list are included in Table 1. Stock assessments are to be attempted periodically for blue, shortfin mako, silky and oceanic whitetip sharks, with the remainder being evaluated through fishery characterisations and/or low information estimations of fishing mortality (F) risk. Table 2 is provided to update the Scientific Committee's assessment schedule for sharks. A new assessment for southwest Pacific blue shark was previously due to start in 2026, however, that was delayed by WCPFC22 where it is proposed that no more shark assessments, which are funded as "WCPFC projects" should be conducted until after a shark and billfish bycatch stock assessment methods workshop is conduct and reported. The workshop was funded at WCPFC22 as Project 130 "Joint bycatch assessment workshop for billfish and sharks". Due to the busy regional calendar and workloads of the SSP, the workshop could not be conducted prior to SC22, and is expected to be conducted in early 2027, to be reported to SC23. **The SC22 will need to consider whether to further postpone the assessment of southwest Pacific blue shark until after SC23.**

Under Table 1 section c(i) there is an item to *Include data poor assessment metrics as standard outputs for data rich assessments where possible*, this is a standing item currently and these metrics have been included in SP-blue shark, and WCPO oceanic whitetip and silky shark assessments. **The SC22 ISG-Sharks may want to review these and provide a specific/refined list for future assessments**. If they are able to do that then this item could be removed from the list, if not it should remain until such time as firm recommendations on these metrics are accepted by the SC.

For SC22 one ongoing project is reporting to SC22 (*Project 126: Biological sampling plans for tuna, billfish & sharks* (SC22-SA-IP-20)). A second project undertaken outside of the SRP is also being presented - *Assessing the vulnerability of elasmobranchs to western and central Pacific tuna fisheries using an improved ecological risk assessment method* (SC22-EB-IP-11). This work assessed 33 elasmobranch species including all WCPFC Key Sharks. "*In summary, 13 of 33*

species assessed were considered 'least vulnerable', 12 'most vulnerable', and eight 'data deficient'. Species considered 'most vulnerable' included several carcharhinids given their low productivity, as well as several Sphyrna *species that are particularly susceptible to mortality when interacting with fishing gears. Deep-set longline gear was responsible for most fishing mortality for most species given its vast effort distribution throughout the WCPO and vertically in the water column."* In addition, there is a *FAO Report on the Blue Shark MSE Workshop* (MI-IP-06) being tabled,

A number of projects are being reported on at SC22 the will include general work including shark data collection or stock assessment planning: *WCPFC Projects 117, 118 & 126: biological sampling plans for tuna, billfish & sharks* (SC22-SA-IP-20); *P130: Joint bycatch assessment workshop for billfish and sharks* (SC22-SA-IP-21); and *Project 35b: WCPFC Pacific Marine Specimen Bank* (SC22-RP-P35b02).

There are two projects that are scheduled to start pending agreement at SC22 ISG-Sharks and approval of the budget at WCPFC23. One stock assessment for southwest Pacific blue sharks (stock assessment project a(i)). One data characterisation of low information sharks and mobulids (stock assessment project a(vii)). One new project has been added to the list for 2028 "a(iv) Comparisons of observer and logbook data for shark species". This project should update the work under WCPFC Project 78 to evaluate changes in logsheet reporting trends and it is recommended that the ISG-Sharks evaluate weather of not to retain this project and consider the proposed start date.

The mitigation project (8(ii)) to estimate post-release survival for silky and oceanic whitetip sharks currently has high priority given the importance of these estimates for the stock assessments and assessing the impacts of non-retention in reducing shark morality. The whale shark post release survival project mitigation project 8(iii) should also be prioritised.

We note that over the years shark related work is consistently underfunded as other target species priorities take precedence. **To address this issue SC may consider whether to allocate a specific budget line item or percentage allocation for shark related work so that funding for these species does not compete with the target stocks.**

A new section has been added to Table 1 (Section 8). Six projects have been moved into this section. It is suggested that these projects are unlikely to ever be funded through the SC budget as they are either too expensive or will remain low priorities for SC compared to tuna or other projects. As such these projects are included as a list for members and NGOs to consider funding.

Two other projects that were proposed for removal by SC21 remain in the Table 1 but have been struck out so that the SC does not revisit this work inadvertently.

Finally, one new project "*Terms of Reference have been provided for information for a project titled: Global and regional environmental niche and favourable feeding habitat of silky shark (Carcharhinus falciformis) by size and sex: a step towards bycatch assessment and mitigation*". This project is included for information but is funded externally and no funding is required. **SC22 ISG-Sharks may provide comment on the value of this work and whether to recommend CCMs to support the work and allow use of their observer data for presence absence records of silky shark.**

Recommendations

1. Consider either apportioning a percentage of the SC budget for shark work or drop projects that have been planned but never approved or those that are prohibitively expensive. These projects are listed in Table 1.8 as projects requiring external funding to progress.
2. SC22 ISG-Sharks review the work plan and project list for the 2027/28 year and make recommendations to SC22 for any changes the SC may want to consider.
3. SC22 ISG-Sharks review the proposed amendments to the stock assessment schedule, including the proposed postponement of the blue shark assessment, and make recommendations to SC22.
4. SC22 ISG-Sharks review the new proposed projects and specifications (provided in Appendix 2) and make any changes for SC22s review.
5. SC22 ISG-Sharks propose the southwest Pacific blue shark assessment for 2027/28, so that it can commence after the Project 130 "*Joint bycatch assessment workshop for billfish and sharks"* and utilise the recommendations from that workshop.
6. SC22 ISG-Sharks consider the start date and priority of project a(iv) "*Comparisons of observer and logbook data for shark species*" and make recommendations to SC22.
7. SC22 ISG-Sharks review the ToR for the project "Global and regional environmental niche and favourable feeding habitat of silky shark (Carcharhinus falciformis) by size and sex: a step towards bycatch assessment and mitigation" and provide a ranking to assist the proponents in securing funding and data access for the work.

References

Brouwer, S. and Hamer, P. 2020. Brouwer, S. and Hamer, P. (2020). 2021-2025 Shark Research Plan. SC16-EB-IP-01 Rev1.

Brouwer, S. and Hamer, P. 2023. Shark research plan 2021-2025 mid-term review. SC19-EB-WP-06.

ISC. 2024. Stock Assessment of Shortfin Mako Shark in the North Pacific Ocean through 2022. SC20-SA-WP-14.

Brouwer, S. and Hamer, P. 2024. Progress against the 2021-2030 Shark Research Plan - 2024. SC20-EB-IP-10.

Brouwer, S. and Hamer, P. 2025. Progress against the 2021-2030 Shark Research Plan - 2025. SC20-EB-IP-19.

Relevant recent publications from outside of the WCPFC

Reference	Comment	Relevance to WCPFC
Assessing the vulnerability of elasmobranchs to western and central Pacific tuna fisheries using an improved ecological risk assessment method. Hill N., Griffiths, S., Allain, V., Nicol, S., Potts, J., Phillip, N.B., Rigby, C. R., 2026. Fisheries Research. | Published 23 May 2026 | https://doi.org/10.1016/j.fishres.2026.107759	Ecological Assessment of the Sustainable Impacts of Fisheries (EASI-Fish), was applied to 33 elasmobranch species that interact with western and central Pacific Ocean (WCPO) tropical tuna fisheries. This quantitative, model-based ecological risk assessment provides estimates of vulnerability for these elasmobranchs. In summary, 13 of 33 species assessed were considered 'least vulnerable', 12 'most vulnerable', and eight 'data deficient'. Species considered 'most vulnerable' included several carcharhinids given their low productivity, as well as several Sphyrna species that are particularly susceptible to mortality when interacting with fishing gears. Deep-set longline gear was responsible for most fishing mortality for most species given its vast effort distribution throughout the WCPO and vertically in the water column.	Relevant for species without more rigorous assessment methods; should in future cover other years as the effort were from 2022 a strong La Nina year with effort compressed to the West; and could be augmented by detailed characterisations of the fisheries as a whole.
Global stock structure of the Silky Shark (Carcharhinus falciformis, Carcharhinidae) assessed with high-throughput DNA sequencing. Kraft, D.W., Conklin, E.E., Freel, E.B., Hutchinson, M., Spaet, J.L.Y., Toonen, R.J., Forsman, Z.H., Grant, M.I., Filmalter, J.D., Hyde, J.R., Gulak, S.J.B., and Bowen, B.W. (2025) PeerJ, 13:e19493 | Published 7 July 2025 DOI: 10.7717/peerj.19493.	The first genomic-scale assessment of global silky shark stock structure, using pool-sequencing and population-level SNP analysis. F_ST values indicate significant population structure within every RFMO's jurisdiction, with 22% of variance explained by RFMO boundaries and 34% by finer-scale DAPC-identified groups. Finds significant discordance between population genetic structure and current RFMO management units, recommending a detailed review of stock boundary definitions. Atlantic and Indo-Pacific populations are clearly differentiated.	Relevant work may need further finer scale analysis within the WCPO. While the analysis did find differences between RFMO boundaries, within the WCPO there was not much difference between sample sites and wider sampling should be undertaken within the WCPO. But the study also found closer relationships between the IOTC and WCPFC than the WCPFC and IATTC which may be an indication of sampling location rather than a real difference.
Evidence for a fisher-designed solution to manta and devil ray bycatch in tuna fisheries. Cronin, M.R., Murua, J., Croll, D.A., Hutchinson, M., Lezama-Ochoa, N., Lopez, J., Murua, H., Palacios, M.D., Restrepo, V., Stewart, J.D., Swimmer, Y., Zilliacus, K.M. and Moreno, G. (2025). Conservation Biology | Published October 22, 2025. DOI: 10.1111/cobi.70150	This study assessed the feasibility and efficacy of a mobulid sorting grid across 41 bycatch capture events on 12 vessels. Mobulids released using the sorting grid were significantly larger than those released by other methods, yet mean handling time remained approximately 3 minutes. Widespread adoption could substantially improve survival of released mobulids. Recommends RFMO adoption of sorting grid requirements to standardise best practices globally. Directly relevant to WCPFC, IOTC, and IATTC bycatch mitigation policy.	Relevant - will inform best handling practices on purse seine vessels within the WCPFC
Integrating behavioral movement and environmental preferences to map critical habitat of whale sharks using long-term satellite tracking in the Indo-Pacific Ocean. Putra, M.I.H., Wirasatriya, A., Sianipar, A., Hasan, A., Setyawan, E., Syakurachman, I., Mambrasar, R., Erdmann, M., Supriatna, J. and Manessa, M.D.M. (2026) Frontiers in Marine Science, Volume 13 | Published 2026 DOI: 10.3389/fmars.2026.1808805	A decade-long study (2015–2025) tracking 70 individual whale sharks from four major Indonesian aggregation sites using satellite telemetry, producing one of the world's largest whale shark tracking datasets. Reveals that the Indo-Pacific whale shark population spans 13 countries, territories, and the high seas, with male sharks spending 40% of their time in the largely unprotected high seas. Indonesia's Saleh Bay and Cenderawasih Bay are confirmed as the only known year-round aggregation sites globally, including a newly discovered neonatal population at Saleh Bay. Directly informed Indonesia's establishment of its first whale shark-focused marine protected area.	Some relevance, for example in spatial risk assessments.

Integrating behavioral movement and environmental preferences to map critical habitat of whale sharks using long-term satellite tracking in the Indo-Pacific Ocean. Putra, M.I.H., Wirasatriya, A., Sianipar, A., Hasan, A., Setyawan, E., Syakurachman, I., Mambrasar, R., Erdmann, M., Supriatna, J. and Manessa, M.D.M. (2026) Frontiers in Marine Science, Volume 13 | Published 2026 DOI: 10.3389/fmars.2026.1808805	A decade-long study (2015–2025) tracking 70 individual whale sharks from four major Indonesian aggregation sites using satellite telemetry, producing one of the world's largest whale shark tracking datasets. Reveals that the Indo-Pacific whale shark population spans 13 countries, territories, and the high seas, with male sharks spending 40% of their time in the largely unprotected high seas. Indonesia's Saleh Bay and Cenderawasih Bay are confirmed as the only known year-round aggregation sites globally, including a newly discovered neonatal population at Saleh Bay. Directly informed Indonesia's establishment of its first whale shark-focused marine protected area.	Some relevance
Projecting the poleward habitat expansion of whale sharks (Rhincodon typus) in the west Pacific and east Indian Ocean in response to climate change. Sohn, D. et al. (2025) Ocean & Coastal Management / ScienceDirect | Published June 2025 DOI: 10.1016/j.ocecoman.2025.xxxxx	Compiles 20 years of whale shark occurrence records (2004–2023) from OBIS, GBIF, and tagging programs to model future habitat suitability across the western Pacific and eastern Indian Ocean. Projects a clear poleward expansion of suitable thermal habitat under warming scenarios, with Ningaloo Reef (Australia) and Philippines aggregation sites remaining important anchors. Governance implications are discussed for the emerging northward range extension into areas such as the Korean peninsula.	Some relevance - suggests that population habitats may change in the Pacific in future, relevant to risk assessments.
Projecting the poleward habitat expansion of whale sharks (*Rhincodon typus*) in the west Pacific and east Indian Ocean in response to climate change. Sohn, D. et al. (2025) Ocean & Coastal Management / ScienceDirect | Published June 2025 DOI: 10.1016/j.ocecoman.2025.xxxxx	Compiles 20 years of whale shark occurrence records (2004–2023) from OBIS, GBIF, and tagging programs to model future habitat suitability across the western Pacific and eastern Indian Ocean. Projects a clear poleward expansion of suitable thermal habitat under warming scenarios, with Ningaloo Reef (Australia) and Philippines aggregation sites remaining important anchors. Governance implications are discussed for the emerging northward range extension into areas such as the Korean peninsula.	Some relevance - suggests that population habitats may change in the Pacific in future.
2025 Shortfin Mako Shark Stock Assessment Meeting Report (North Atlantic). ICCAT SCRS Working Group (2025) ICCAT SCRS | 2025 Shortfin Mako Stock Assessment Meeting	The 2025 North Atlantic shortfin mako assessment attempted to apply the Stock Synthesis (SS3) platform with biological scenario grids exploring steepness and natural mortality at age. After considerable effort, credible model results could not be obtained. The Group identified the need to develop a new workplan with options to redo the assessment in 2026. This represents a significant setback for mako management in the Atlantic. The failure reflects known challenges in modelling K-selected species with high parameter uncertainty.	Methodological relevance. Consistent with the issues faced in mako shark assessment in the southwest Pacific that failed to produce credible management advice.
Population genetics of the scalloped hammerhead shark *(Sphyrna lewini*) in the Gulf of Mexico: evaluating fine scale female philopatry and its importance for management and conservation. Alfonso-González, M., Llanes-Quevedo, A., Mar-Silva, A.F. et al. (2025) Hydrobiologia, 852, 2805–2818 | Published January 2025 DOI: 10.1007/s10750-025-05796-3	Investigates fine-scale population genetic structure of scalloped hammerhead sharks across the Gulf of Mexico using mitochondrial and nuclear markers. Evaluates evidence for female philopatry to coastal nursery grounds, a key driver of genetic differentiation and a factor directly relevant to regional management unit designation for this Critically Endangered species.	Low relevance - localised study
Ghosts of the current: environmental DNA assays to detect conservation priority areas for three critically endangered hammerhead sharks. Cardeñosa, D. (2025) Frontiers in Marine Science, Volume 12 | Published 30 September 2025 DOI: 10.3389/fmars.2025.1688088	Developed and validated species-specific eDNA assays targeting mitochondrial NADH2 and Control Region sequences to detect three critically endangered small-bodied hammerhead sharks (scalloped bonnethead, scoophead, and Pacific bonnethead) without capture. All assays showed high specificity ($R^2 > 0.99$), and in situ validation in Uramba/Bahía Málaga National Natural Park, Colombia, confirmed presence of all three species. Offers a transformative non-invasive tool for distribution monitoring of data-deficient, low-abundance elasmobranch species.	Some relevance as eDNA offers potential for mapping species distribution and recovery trends. This is an area that is worth exploring, given the decline in fishery dependent data.
Exploring practical conservation measures for pelagic thresher sharks using local knowledge in Sunda Banda seascape. **Shidqi, R.A., Bang,**	Investigates fishing community knowledge of pelagic thresher shark interactions in the Sunda Banda seascape of eastern Indonesia, which is identified	Low relevance local study

Y.M., Tukan, M.B.Y. et al. (2025). Frontiers in Ocean Sustainability, Volume 3 | Published 19 March 2025. DOI: 10.3389/focsu.2025.1533340	as a hotspot and migration corridor for this Endangered species. Uses focus group discussions and surveys with fishers to characterise bycatch interactions, species co-occurrences (including scalloped hammerhead and giant manta), and attitudes toward conservation interventions. Provides data for management design in a country that is the world's largest shark fishing nation.	

Major conservation policy events

Resolution 25/08 on the Conservation of Sharks in Association with Fisheries Managed by IOTC - IOTC Commission (2025)

IOTC adopted a shark conservation resolution in 2025. Resolution 25/08 includes non-retention provisions for select species and full utilisation requirements for others, mitigation provisions; requiring follow-up scientific tasks from the Scientific Committee to deliver management advice at the 2026 Commission session. The resolution covers species including blue shark, silky shark, bigeye thresher, pelagic thresher, oceanic whitetip, scalloped hammerhead, giant manta, and spinetail devil ray.

CITES Appendix I listings

In November 2025, CITES CoP20 (20th Conference of the Parties) amended the status of a number of the WCPFC key sharks by listing them on Appendix I. Appendix I is the highest level of protection, covering species that are threatened with extinction and may be affected by international trade.

- Giant manta ray (*Mobula birostris*), Reef manta ray (*M. alfredi*), Spinetail devil ray (*M. mobular*), and seven additional devil ray species were listed on CITES Appendix I.
- Whale shark (*Rhincodon typus*) was revised from CITES Appendix II to Appendix I.
- Oceanic whitetip shark (*Carcharhinus longimanus*) was listed to CITES Appendix I.

Table 1: *The 2021-2030 shark work as agreed at SC19 (TABLE SHK-01) and updated for 2025. Completed and deleted projects retained deliberately so that they are not inadvertently re-included. Project for consideration to start in 2027 are highlighted.*

1. Stock assessment				
Title	**Priority**	**Start year**	**End year**	**Comments**
(a) Determine the stock status for WCPFC key sharks				
i) Southwest Pacific blue shark assessment	High	2027	2028	Postponed for one year to consider recommendations from the stock assessment methods.
ii) North Pacific blue shark assessment	High	2026	2027	
iii) Southwest Pacific shortfin mako shark assessment	High	2027	2028	This will also need to be re-considered as overlaps with delayed southwest Pacific blue shark.
iv) North Pacific shortfin mako shark assessment	High	2023	2024	Completed SC20-SA-WP-14.
v) WCPO silky shark assessment	High	2023	2024	Completed (papers SC19-SA-WP-103; SC19-SA-IP-094; and SC20-SA-WP-04_rev2
vi) WCPO oceanic whitetip shark assessment	High	2024	2025	Completed (papers SC20-SA-WP-11, SC20-SA-IP-23 SC21-SA-WP-08
vii) Fishery data characterisation low information sharks	High	2027	2027	Updated and merged characterisation projects from 2025 SRP.
viii) Project 130 "Joint bycatch assessment methods workshop for billfish and sharks"	Med	2026	2027	SC22 support for a no cost extension request to go to WCPFC23
ix) Ecological risk assessment of Pacific sharks	NA	2026	2026	Completed outside of the SRP SC22-EB-IP11
(b) Develop reliable catch histories, assessment methods and data input improvements				
i) Redefining the fleets currently assumed in the BSH NP stock assessment	Medium	2021	2022	Work completed (ISC/21/SHARKWG-2/I-01) the results indicate that no change to the fleet composition used in the assessment was required.
ii) Developing a statistically robust and spatial/temporal optimized sampling	High	2025	2025	Project 126 project report to be tabled at SC21 (SA-WP-12)

strategy for biological data collection – consider ISC's approach				
iii) Comparisons of observer and logbook data for shark species	TBD	2028	2028	Update of WCPFC Project 78.
(c) Test and improve medium and data poor assessment methods to inform management decisions				
i) Include data poor assessment metrics as standard outputs for data rich assessments where possible	High	Ongoing	Ongoing	Completed in SP-BSH, SP-mako and FAL - SC Shark ISG may want to review these and provide a specific list for future assessments. Wil be included in the assessment methods workshop.
(d) Assess the success of management				
Review the impact of CMM 2022-04	High	2028	2028	SC19 survey 100% agreement on priority and start date

2. Mitigation				
Title	**Priority**	**Start year**	**End year**	**Comments**
(a) Provide advice on mitigation Sharks with non-retention policies and unwanted elasmobranchs				
~~i) Investigate effective mitigation for WCPFC Key Sharks~~	~~Medium~~	~~2023~~	~~2025~~	~~Project continues to be considered low priority - this project should be dropped.~~
~~ii) Investigate mitigation method trade-offs between mitigation methods for sharks, seabirds and sea turtles~~	~~Medium~~	~~2023~~	~~2025~~	~~Project continues to be considered low priority - this project should be dropped.~~
(b) Provide advice on safe release methods and assess release survival of WCPFC Key Sharks				

3. Biology				
Title	**Priority**	**Start year**	**End year**	**Comments**
(a) Increase the understanding of important biological parameters of WCPFC Key Sharks				
i) Silky shark and oceanic whitetip shark	High	2027	2030	Included in general biological sampling

	reproductive biology and longevity				(project 126). (SC22-SA-IP14)
ii)	Biology and life history of hammerhead sharks	High	2025	2027	Included in general biological sampling (project 126). (SC22-SA-IP20)
iii)	Resolving blue shark reproductive biology and reproductive schedule	Medium	2025	2027	Included in general biological sampling (project 126). (SC22-SA-IP20)
iv)	Biology of the longfin mako shark	Medium	2025	2027	Included in general biological sampling (project 126). (SC22-SA-IP20)
v)	Life history of thresher sharks	Medium	2025	2027	Included in general biological sampling (project 126). (SC22-SA-IP20)
vi)	Validated life history, biology, and stock structure of the shortfin make in the South Pacific	Medium	2025	2027	Included in general biological sampling (project 126). (SC22-SA-IP20)
vii)	Age validation and stock structure of the silky shark and oceanic whitetip shark	Low	2025	2027	Included in general biological sampling (project 126). (SC22-SA-IP20)
~~viii)~~	~~Stock structure and life history of southern hemisphere porbeagle shark~~	~~Low~~			Removed by SC19 - this project as should be undertaken by CCSBT.
ix)	Biology of manta and mobulid rays	High	2027	2030	Included in general biological sampling (project 126). (SC22-SA-IP20)
x)	Stock structure of manta and mobulid rays	High	2027	2028	Included in general biological sampling (project 126). (SC22-SA-IP20)
xi)	Stock structure of hammerhead sharks	Low	2026	2030	Included in general biological sampling (project 126). (SC22-SA-IP14)
xii)	Genetic CKMR (and stock structure and natal homing) scoping study all species	Medium	2026	2027	Included in general biological sampling (project 126). (SC22-SA-IP20 and SC22-RP-P35b01)
xiii)	Review of non-lethal approaches to collect life-history data (e.g., reproductive status from	Medium	2025	2026	Included in general biological sampling (project 126). (SC22-SA-IP20 and SC22-RP-P35b01)

blood samples) to inform observer training				

4. Observer data				
Title	**Priority**	**Start year**	**End year**	**Comments**
(a) Improve spatio-temporal observer data for informing scientific needs				
i) Training observers in the WCPO to be proficient in species identification	High	ongoing	ongoing	Material developed by SPC: Park T., Marshall L., Desurmont A., Colas B. and Smith N. 2019. Shark and ray identification manual for observers and crew of the western and central Pacific tuna fisheries. Noumea, New California: Pacific Community . 79p. Observer training ongoing
ii) Training observers for extraction and storage of vertebrae and shark reproductive material	High	2021	ongoing	SPC currently getting the protocols developed for shark biological sampling through a consultant. This work is underway. This should also ensure that observer training covers good sampling practices for genetic tissue sampling to reduce cross-contamination.
iii) Training observers for on-deck reproductive staging of elasmobranchs	High	2021	ongoing	SPC currently getting the protocols developed for shark biological sampling through a consultant. This work is underway.
iv) Measuring elasmobranchs on purse seine and longline vessels for length-length and length-weight conversion factor development	High	ongoing	ongoing	ROP training conversion factor measurements have just been introduced – COVID delay.

8. Management advice				
i) Oceanic whitetip and silky shark in longline fisheries between 20N and 20S and outside the area to evaluate CMM 2022-04	NA	2024	2024	Completed - SC20-EB-WP-05

9. Projects considered relevant but beyond the WCPFC funding capacity				
Title	**Priority**	**Start year**	**End year**	**Comments**
i) Satellite tagging of mako sharks (juveniles and adults) in NZ, AU and the high seas east of NZ (genetic analysis also mentioned regarding natal homing)	Medium	TBD	TBD	This project should be re-purposed as a genetics project.
ii) Feasibility of tag-recapture methods to obtain estimates of M (for SP shortfin mako)	Medium	TBD	TBD	Dropped by SC19
iii) Estimate silky and oceanic whitetip shark post release survival from WCPO longline fisheries	High	TBD	TBD	SC19 survey 59% high priority. Post-release survival estimates are now included in the assessment, and non-retention is the primary shark conservation measure.
iv) Estimate whale shark post release survival from WCPO purse seine fisheries	TBD	TBD	TBD	SC-ISG-Sharks to add a schedule and SC21 should prioritise this project.
v) Estimate the retention time of elasmobranchs entangled in FADs	Low	TBD	TBD	Drop this project as no longer needed.
vi) Spatio-temporal abundance patterns and drivers of abundance indices for SP shortfin mako	Medium	TBD	TBD	SC19 survey 55% medium start date 2025

Table 2: Shark stock assessment table. Note this includes all assessment types from data rich to low information assessment models. The assessment type will be determined by the SC ISG-Sharks for each successive year. Shark assessments are currently scheduled 5-yearly. A = Assessment; I = Indicator analysis; L/C = Low information assessment or characterisation; X = Scheduled work moved; U = Assessment tabled but not accepted. Red letters indicate proposed change from the SRP or additions. A - revised assessment grid and management advice.*

Species	Stock	Last assessment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Blue shark	Southwest Pacific	2022	A	A*					A	A		
	North Pacific	2022		A			I	A	A			
Shortfin mako	Southwest Pacific	2022		A					LC	LC		
	North Pacific	2024			A			I		A		
Silky shark	WCPO	2024			A					A		
Oceanic whitetip shark	WCPO	2025				A						A
Pelagic thresher	WCPO	-							Data characterisation			
Bigeye thresher	Pacific	2017										
Common thresher	WCPO	-										
Greater hammerhead	WCPO	-										
Smooth hammerhead	WCPO	-										
Scalloped hammerhead	WCPO											
Winghead shark	WCPO	-										
Giant manta	WCPO	-										
Reef manta	WCPO	-										
Spinetail devil ray	WCPO	-										
Whale shark	WCPO	2018 (risk assessment)										

Appendix 1 – Recommendations from the most recent stock assessments

Appendix 1 includes the recommendations and research considerations from the most recent shark assessments presented at SC21, which only included oceanic whitetip sharks. These are included for reference for the ISG-Billfish when considering research priorities.

Stock Assessment	Recommendations
Stock Assessment of Oceanic Whitetip Shark in the Western and Central Pacific Ocean: 2025. Neubauer and Large. SC21-SA-WP-08.	1. Improve observer data protocols: To counter the degradation of data quality resulting from the non-retention conservation measure (CMM-2011-04), it is recommended that longline observer programmes implement clear and consistent directives for recording all capture events, especially unobserved ”discarded-cut-free” (DCF) individuals. Furthermore, recording approximate length measurements for sharks released in the water, a practice already in place in some programmes, should be standardised across the Western and Central Pacific Ocean. 2. Prioritise research on stock structure and connectivity: Fundamental uncertainty remains regarding the stock structure of OCS in the Pacific Ocean. It is recommended that CCMs prioritise and support planned work under the WCPFC’s Shark Research Plan (SRP) involving satellite tagging and expanded genetic/genomics studies to address questions of regional residency, mixing, and stock boundaries. 3. Resolve conflicting life history parameters: The significant divergence between available growth studies remains a considerable factor for the uncertainty in stock productivity. To build a more robust understanding of this species’ life history, it is recommended that work scheduled under the SRP to conduct additional growth studies and validate ageing methods from a range of locations be prioritised. 4. Continue multi-model assessment frameworks: Given the persistent conflict between CPUE and length data, it is recommended that future assessments continue to use multi-model approaches. The use of simpler models, such as the Dynamic Surplus Production Model, alongside integrated age-structured models, provides a vital cross-assessment, and ensures management advice is robust to structural uncertainty. 5. Refine historical catch estimates: Although progress has been made, the catch history for the longline fishery remains uncertain with considerable discrepancies between studies. It is recommended that shark catch reconstructions be reviewed, and these discrepancies be explored to gain an improved understanding of core uncertainties. 6. Review and document recent improvements in shark assessment methodologies: With the present assessment, a full cycle of assessments has now been undertaken for blue, mako, silky and oceanic whitetip sharks, using consistent assessment methods, consistently refined over time. A review workshop and summary paper to capture recent progress and outstanding challenges is recommended to provide a solid basis for upcoming work, and provide an opportunity to share these advances across RFMOs. We recommend this workshop be considered by the Informal Small Working Group: Sharks for inclusion and prioritisation in the Shark Research Plan update at SC21.

Appendix 2 – Draft project specifications for 2027 projects for evaluation and completion by SC22 ISG-Sharks

Part A: Administrative Summary	
1. Project Title	Data characterisation of low information sharks and mobulids
2. Organization	Submitted by the SRP
3. Administrative Contact	TBD - SPC
4. Principal Investigator (PI) and CV	TBD - SPC
5. Commencement and Completion Date	1 March 2027 - 31 August 2027
6. Project Budget Summary	Overview of major cost categories: o Project budget - $30,000 o Travel to SC23 $10,000 o Operating Costs (e.g., equipment, supplies) - NA o Other Costs (e.g., sub-contracts, dissemination) - NA
Part B: Project Proposal Description	
1. Project Title	As above
2. Background and Need	See Rationale
3. Objectives and Benefits	See scope of work
4. Note	This project was given a medium score by SC21, it was not funded in 2025 and is being tabled again. It could be conducted in 2027 in place of blue shark if that assessment was delayed until after SC23 pending the report for the Project 130 workshop.
5. Rationale	Some general characterisations of the data have been undertaken (WCPFC-SC12-2016/EB-WP-08) and methods for assessment have been proposed (WCPFC-SC16-2020/SA-IP-12). Some species are all listed on CITES Appendix II and mantas are considered to be globally endangered by IUCN. There are relatively high observed longline catches of mantas and mobulids and some whale shark unintended interactions with the purse seine fishery. Other species such as hammerheads have unknown trends and fishery interactions.
6. Assumptions	• Sufficient existing fisheries and biological data are readily available from the WCPO or other sources. • Personnel are available to undertake this work.
7. Scope of Work	1. This work should include all threshers, hammerhead sharks and manta rays. 2. Reviewing any previous work in the WCPO on these species. 3. Present a characterisation of the data and fisheries interacting with or catching these species. 4. Attempt to develop WCPO abundance indices using observer data. 5. Attempt to present the stock status or trends in terms of the metrics outlined in the 2021-2025 Shark Research Plan. 6. Provide a report containing the above results for SC23.

8. Activity Schedule	Access the SPC data (March 2027) Undertake the analysis (April-June 2027) Compile the report and submit to SC23 (June/July 2027)
9. Project Outcomes	Report document and presentation to SC23.
10. Forms of Results	Report document and presentation to SC23.
11. Methods	TBD
12. Data Management Plan / Data Sets Required	SPC held set level logsheet and observer data.
13. Other Related Projects	NA
14. Collaborations	TBD
15. Project Staff and CVs	TBD
16. Risks of Project Not Achieving Objectives	SPC staff or consultant availability
17. Timeframe	As above
18. Budget	As above
19. References	WCPFC-SC09-2013/EB-WP-01 WCPFC-SC11-2015/EB-WP-03 WCPFC-SC12-2016/EB-WP-08 WCPFC-SC14-2018/SA-WP-12 (rev.1) WCPFC-SC16-2020/SA-IP-12

Part A: Administrative Summary	
1. Project Title	Stock assessment of southwest Pacific blue shark
2. Organization	Submitted by the SRP
3. Administrative Contact	TBD - SPC
4. Principal Investigator (PI) and CV	TBD - SPC
5. Commencement and Completion Date	Phase 1: 1 March 2027 - 31 August 2027 Phase 2: 1 March 2028 - 31 August 2028
6. Project Budget Summary	Overview of major cost categories: Phase 1: data preparation, catch reconstruction and CPUE standardisation. o 0.4 FTE ($50,000 – 2027) o No Travel Phase 2: stock assessment o 0.4 FTE ($50,000 – 2028) o SC travel ($10K) Operating Costs (e.g., equipment, supplies) - NA Other Costs (e.g., sub-contracts, dissemination) - NA
Part B: Project Proposal Description	
1. Project Title	As above
2. Background and Need	See Rationale
3. Objectives and Benefits	Undertake a stock assessment of blue sharks in the southwest Pacific: phase 1, data preparation, catch reconstruction and CPUE standardisation.

4. Note	Depending on the priorities of the SC for the work to be undertaken by the Scientific Services Provider (SSP), this project may be undertaken within the service agreement with the SSP or alternatively as a standalone project with a separate funding allocation. This will need to be decided by the SC20 considering the other priorities. Note the Project 130 "Joint bycatch assessment workshop for billfish and sharks" is expected to occur early 2027 and be reported to SC23. SC22 may prefer that the outcomes and recommendations from that workshop be taken into account, before committing funds to a new southwest Pacific blue shark assessment for 2027.
5. Rationale	This stock was last assessed in 2022 (SC18-SA-WP-03) using data from 1995-2020. The southwest Pacific blue shark is unlikely to be overfished and it is unlikely that overfishing is occurring when considered against MSY and depletion-based reference points. Since the last assessment, more catch and effort data as well as observer data are available. This project is designed to assess the stock status of southwest Pacific blue sharks using the most informative approach with respect to the available data. The assessment should assess the stock status against conventional stock assessment metrics as well as those suggested in the WCPFC 2021-2025 Shark Research Plan (SC16-EB-IP-01 rev1). NOTE: In early 2027, Project 130 "Joint bycatch assessment workshop for billfish and sharks" will be conducted to provide recommendations of shark and billfish assessment methods. The recommendations of the workshop will be relevant to this assessment.
6. Assumptions	• Much of the existing fisheries and biological data are readily available from the WCPO. • Assessment personnel are available to undertake this work.
7. Scope of Work	1. Reviewing the previous assessment in the WCPO to assess and improve on methods to increase the understanding of data strengths and weaknesses, and update stock status. 2. Update WCPO longline catch estimates and abundance indices using recent observer data. 3. Present the stock status in terms of the metrics outlined in the 2021-2025 Shark Research Plan. 4. Provide a report on the phase 1 work to SC23, and the proposed assessment approach for phase 2, taking account of the recommendations from the Project 130 workshop.
8. Activity Schedule	March 2027 – August 2028 PHASE I: March 2027-August 2027 (data compilation, fishery characterisation and catch reconstructions) PHASE II: March 2028-August 2028 (Stock assessment)
9. Project Outcomes	Report document and presentation to SC23 and SC24.
10. Forms of Results	Report document and presentation to SC23 and SC24.
11. Methods	TBD
12. Data Management Plan / Data Sets	SPC held set level logsheet and observer data.

Required	
13. Other Related Projects	NA
14. Collaborations	TBD
15. Project Staff and CVs	TBD
16. Risks of Project Not Achieving Objectives	SPC staff or consultant availability
17. Timeframe	As above
18. Budget	As above
19. References	SC18-SA-WP-03 SC20-SA-WP-04 SC20-SA-WP-11 SC21-SA-WP-08

Project included for information but no budget required

Part A: Administrative Summary	
1. Project Title	Global and regional environmental niche and favourable feeding habitat of silky shark (*Carcharhinus falciformis*) by size and sex: a step towards bycatch assessment and mitigation
2. Organization	Submitted by IATTC & JRC. In collaboration with the Pacific Community (SPC)
3. Administrative Contact	Jon Lopez Email: jlopez@iattc.org Jean-Noël Druon Email: jean-noel.druon@ec.europa.eu
4. Principal Investigator (PI) and CV	Jon Lopez (IATTC) — Head and Senior Scientist in the Ecosystem and Bycatch Program, with expertise in tropical tuna and FAD-associated fisheries, pelagic-shark bycatch, and the translation of habitat predictions into spatial management; co-author, among others, of the blue shark niche analysis (Druon et al., 2022) and of the tuna-RFMO bycatch-mitigation framework (Bowlby et al., 2024). Jean-Noël Druon (JRC, EC) — lead developer of the ecological-niche / favourable feeding habitat modelling framework applied to highly migratory species, including blue shark, skipjack tuna and Atlantic bluefin tuna, and of the operational fish-habitat products disseminated through the European Commission's sustainable-fisheries portal and the JRC Data Catalogue.
5. Commencement and Completion Date	1 January 2027 - 31 December 2027
6. Project Budget Summary	No funding is requested from the WCPFC
Part B: Project Proposal Description	
1. Project Title	As above
2. Background and Need	See Rationale
3. Objectives and Benefits	1. Identify the common environmental envelope (feeding and physical predictors) associated with silky shark presence globally and across the WCPO. 2. Derive size- and sex-specific niches (e.g. juveniles vs. adults; males vs. females) subject to data availability and identified differences in the niches. 3. Produce daily/8-day and climatological (monthly, seasonal) maps of favourable habitat since 2002, with associated statistics on habitat extent and variability. 4. Explore candidate thresholds delineating “essential” habitat and illustrate the benefits of potential spatiotemporal mitigation options for special areas of interest, following the framework demonstrated for blue shark. 5. Provide habitat layers usable as spatio-temporal covariates and silky shark essential habitat by eventual distribution priors for stock assessment and for the interpretation of observer data. Benefits for WCPFC: improved understanding of overlap between fishing effort and sensitive life stages; and inputs that strengthen assessment and ecosystem-based advice.

4. Note	The project delivers a deterministic, presence-based ecological-niche / favourable-feeding-habitat model for silky shark. It is not a stock assessment and does not estimate abundance; rather, it characterizes potential habitat from environmental conditions, by sex and size, and can complement the regional silky shark assessments, especially in the context of environmental change. Outputs depend on access to silky shark presence data with date, position and, ideally, size and sex; original data will be used to extract environmental conditions and shown only to produce aggregated analyses, while the derived habitat outputs will be made publicly available. Set level data are required but no vessel or flag details are needed.
5. Rationale	The approach extends a method already validated for highly migratory species, for example: skipjack tuna in the Atlantic and Indian Oceans (Druon et al., 2017), Atlantic bluefin tuna by size class (Druon et al., 2016) and, most directly, the global blue shark niche by size and sex (Druon et al., 2022). For blue shark, Bowlby et al. (2024) showed how such habitat predictions can be turned into a publicly accessible spatial bycatch-mitigation options for tuna RFMOs. The mechanistic method is particularly appropriate for the silky shark because: the species presence is likely linked to ecologically meaningful predictors near the sea surface - chlorophyll-a fronts as a proxy for productive feeding areas, together with a thermal and physical envelope (surface and subsurface temperature, mixed-layer depth, sea-surface-height anomaly and currents). Compared to purely correlative methods, this makes the model transferable across regions and periods, robust in data-poor settings, and independent of the catch-rate biases that limit conventional indices for a data-poor retention-prohibited species. The blue shark - a somehow ecologically comparable oceanic carcharhinid - provides a near-direct template for parameterization and validation.
6. Assumptions	• Sufficient silky shark presence data (satellite-tag and/or observer capture positions) can be assembled for the WCPO, ideally resolved by size and sex. • Satellite ocean-colour (since ~2002) and physical reanalysis/operational products (Copernicus Marine) remain available and comparable over the study period. • **Data-providing institutes and the WCPFC/SPC cooperate in supplying and, where needed, jointly interpreting the data. Data from other regions is already available: Eastern Pacific Ocean, Indian and Atlantic Oceans.** • The environmental drivers identified for ecologically similar species are relevant to the silky shark and can be re-estimated for it.
7. Scope of Work	1. Compilation and quality control of silky shark presence data (tagging and fishery observations) with date, position, and size/sex where available. 2. Extraction and harmonization of environmental predictors at presence locations and over the WCPO grid. 3. Identification of the environmental niche and feeding-habitat envelope, overall and by size/sex class.

<table>
<tr><td></td><td>4. Modelling and mapping of favourable habitat (daily/8-day, monthly, seasonal and interannual) since 2002, with habitat-variability statistics.
5. Independent validation against withheld presence data and potential comparison with fishing-effort distributions.
6. Definition of essential-habitat thresholds and illustration of benefits for potential spatiotemporal mitigation options, eventually using overlap with target species.
7. Support to assessment efforts by identifying special areas of interests, with potential developments in real-time for bycatch mitigation.
8. Reporting: a Scientific Committee working paper, a peer-reviewed publication, and public maps/datasets.</td></tr>
<tr><td>8. Activity Schedule</td><td><table>
<tr><th>Activity / milestone</th><th>Months</th></tr>
<tr><td>Data-sharing agreements; compilation and quality control of data</td><td>1–3</td></tr>
<tr><td>Environmental data acquisition and processing</td><td>2–4</td></tr>
<tr><td>Niche identification; size/sex classes</td><td>5–7</td></tr>
<tr><td>Habitat modelling and time-series mapping (since 2002)</td><td>7–8</td></tr>
<tr><td>Validation and essential-habitat thresholds</td><td>7-8</td></tr>
<tr><td>Mitigation scenarios; public maps and datasets</td><td>8–9</td></tr>
<tr><td>SC working paper and peer-reviewed manuscript</td><td>10–12</td></tr>
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<tr><td>9. Project Outcomes</td><td>Report document and presentation to SC24.</td></tr>
<tr><td>10. Forms of Results</td><td>Report document and presentation to SC24.</td></tr>
<tr><td>11. Methods</td><td>An ecological-niche modelling favourable-feeding-habitat approach is used, as developed, for example, for blue shark, skipjack and bluefin tuna:
• Presence data (satellite tags and fishery observations) are matched to environmental predictors at the date and location of occurrence.
• A feeding proxy is built from chlorophyll-a horizontal gradients (productivity fronts) derived from satellite ocean colour, capturing mesoscale features that concentrate prey; in oligotrophic areas, mesopelagic/micronekton indicators are considered, as for blue shark, for testing.
• A physical envelope is defined from sea-surface temperature and a subsurface temperature reference (e.g. temperature ~100 m below the mixed layer depth), mixed-layer depth, sea-surface-height anomaly and current velocity, to exclude unsuitable abiotic conditions.
• A common environmental envelope is identified from the distribution of predictors at presence points; regional, size- and sex-specific</td></tr>
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	envelopes are estimated where data allow and different niches are identified. • Favourable habitat is mapped over the globe and the WCPO at daily/8-day resolution and aggregated to monthly, seasonal and interannual climate data (since 2002, the start of consistent ocean-colour records). • Models are validated against withheld presence data, including electronic tagging (fisheries independent) data, and compared, where possible, with the distribution of existing fishing effort; essential-habitat thresholds are then derived and translated into potential mitigation options with associated protection-efficiency proxies and metrics. • Environmental inputs are drawn from the EU Copernicus Marine Service (physical reanalysis/operational products) and from satellite ocean-colour archives. Models are independently validated using withheld presence data.
12. Data Management Plan / Data Sets Required	Data needed from WCPFC / SPC: • Silky shark observer records (presence data; purse-seine and longline) with date, precise position and, where available, size and sex; associated effort for overlap analysis, if possible. • Any available silky shark electronic-tagging data held or coordinated by the Secretariat or partners. Data access is intended to be formalized through the project's inclusion in the Shark Research Plan. Storage, security and sharing: • Confidential original data are stored securely by the IATTC/JRC Senior Scientists, used only to produce aggregated analyses, and not redistributed, consistent with the data-use agreements with each provider. Data will be erased after the analysis. • No confidential data will be published. Only derived, aggregated outputs (habitat maps, statistics) are published; these are made openly available via the EC portal and the JRC Data Catalogue and the associated publications. Data are handled following the strictest confidentiality principles (e.g., IATTC rules of confidentiality) and EC data-protection and confidentiality rules.
13. Other Related Projects	• WCPFC Shark Research Plan (2021–2030) (SRP) and its project list (Brouwer and Hamer, 2020; SC19-EB-WP-06; SC21-SA-IP-19); this project is proposed for inclusion in the SRP and is designed to complement, not duplicate, existing SRP tasks. • WCPFC silky shark stock assessment (Project 108; WCPFC-SC20-2024) and earlier WCPO/Pacific-wide assessments (Rice and Harley, 2013; Clarke et al., 2018).

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Complementary to mitigation and survival work, including silky shark post-release survival studies and the bycatch release-device trials on purse-seiners tabled at SC21; exploration of spatiotemporal habitat avoidance offers a preventive complement to at-vessel handling measures.
The illustrative example of the global blue shark niche by size and sex and its operational habitat products (Druon et al., 2022) and the associated tuna-RFMO bycatch-mitigation framework (Bowlby et al., 2024).
Other similar examples of target species: feeding-habitat models for skipjack tuna (Druon et al., 2017) and Atlantic bluefin tuna (Druon et al., 2016).
Parallel t-RFMO interest (IATTC, ICCAT, IOTC) in exploring options for spatiotemporal management of pelagic sharks, ensuring synergy and avoiding duplication

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<tr><td>14. Collaborations</td><td>

IATTC and JRC (EC) — joint leads: bycatch, FAD-fishery and spatial-management expertise and cross-RFMO coordination (IATTC); model development, environmental processing, mapping and dissemination (JRC).
Pacific Community (SPC) – Oceanic Fisheries Program — data provision and assessment and mitigation linkage.
Data-providing institutes and tagging programs — presence data and ecological expertise; co-authorship of the resulting publication. Collaborators from the eastern Pacific Ocean, as well as the Indian and Atlantic Oceans have been confirmed.
T-RFMO and academic scientists from the tuna and tuna-like fisheries network — cross-validation and management framing.
Other national and regional observer programs — fishery observation data and interpretation.

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<tr><td>15. Project Staff and CVs</td><td>Jon Lopez (IATTC); Jean-Noël Druon (JRC); and SPC-OFP assessment and bycatch scientist(s)</td></tr>
<tr><td>16. Risks of Project Not Achieving Objectives</td><td>
<table>
<tr><th>Risk</th><th>Mitigation</th></tr>
<tr><td>Delays in data provision or restrictive sharing terms</td><td>Early data-use agreements; use of aggregated/secured data; phased analysis starting with available presence data</td></tr>
<tr><td>Sparse size/sex information</td><td>Begin with a pooled niche; add size/sex classes as data allow; leverage blue shark priors where possible</td></tr>
<tr><td>Limited validation data in some areas</td><td>Cross-validation, withheld-data testing and effort-overlap checks; clear uncertainty reporting</td></tr>
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<tr><td>17. Timeframe</td><td>As above</td></tr>
</table>

18. Budget	As above
19. References	[1] Bowlby H, Druon JN, Lopez J, Juan-Jordá MJ, Carreón-Zapiain MT, Vandeperre F, Leone A, Finucci B, Sabarros PS, Block BA, Arrizabalaga H, Afonso P, Musyl MK, Coelho R, Cortés E, Cardoso LG, Mourato B, Queiroz N, Fontes J, Abascal FJ, Zanzi A, Hazin HG, Bach P, Sims DW, Travassos P (2024). Global habitat predictions to inform spatiotemporal fisheries management: initial steps within the framework. Marine Policy 164: 106155. DOI: 10.1016/j.marpol.2024.106155. [2] Druon JN, Campana S, Vandeperre F, Hazin FHV, Bowlby H, Coelho R, Queiroz N, et al. (2022). Global-scale environmental niche and habitat of blue shark (Prionace glauca) by size and sex: a pivotal step to improving stock management. Frontiers in Marine Science 9: 828412. DOI: 10.3389/fmars.2022.828412. [3] Druon JN, Chassot E, Murua H, Lopez J (2017). Skipjack tuna availability for purse seine fisheries is driven by suitable feeding habitat dynamics in the Atlantic and Indian Oceans. Frontiers in Marine Science 4: 315. DOI: 10.3389/fmars.2017.00315. [4] Druon JN, Fromentin JM, Hanke AR, Arrizabalaga H, Damalas D, Tičina V, et al. (2016). Habitat suitability of the Atlantic bluefin tuna by size class: an ecological niche approach. Progress in Oceanography 142: 30–46. DOI: 10.1016/j.pocean.2016.01.002. [5] Rice J, Harley S (2013). Updated stock assessment of silky sharks in the western and central Pacific Ocean. WCPFC-SC9-2013/SA-WP-03. Western and Central Pacific Fisheries Commission. [6] Clarke S, Langley A, Lennert-Cody C, et al. (2018). Pacific-wide silky shark (Carcharhinus falciformis) stock status assessment. WCPFC-SC14-2018/SA-WP-08. Western and Central Pacific Fisheries Commission. [7] WCPFC-SC20 (2024). Stock assessment of silky shark in the Western and Central Pacific Ocean: 2024 (Project 108). WCPFC-SC20-2024/SA-WP-04. [8] WCPFC (2013). Conservation and Management Measure for silky sharks. CMM 2013-08. Western and Central Pacific Fisheries Commission. [9] Brouwer S, Hamer P (2020). 2021–2025 Shark Research Plan. WCPFC-SC16-2020/EB-IP-01 Rev1 (subsequently extended as the 2021–2030 Shark Research Plan). [10] WCPFC-SC19 (2023). Shark Research Plan 2021–2025 mid-term review (Project 97b). WCPFC-SC19-2023/EB-WP-06. [11] Brouwer S, Hamer P (2025). Progress against the 2021–2030 Shark Research Plan — 2025. WCPFC-SC21-2025/SA-IP-19. [12] Rigby CL, Sherman CS, Chin A, Simpfendorfer CA (2017, amended 2021). Carcharhinus falciformis. The IUCN Red List of Threatened Species: e.T39370A117721799. (Vulnerable). CITES Appendix II.

	[13] Online resources — EC sustainable-fisheries fish-habitat maps and animations; JRC fish-habitat datasets (JRC Data Catalogue).